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ИНСТИТУТ ЭЛЕКТРОННЫХ И ИНФОРМАЦИОННЫХ СИСТЕМ

КАФЕДРА ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ И СИСТЕМ

Лабораторная Работа №2. Сортировки

Отчет по лабораторной работе №2 по учебной дисциплине «Алгоритмические языки и программирование»

по специальности 09.03.01 Информатика и вычислительная техника

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## Постановка задачи

Разработка программы с графическим интерфейсом для сортировки массивов.

## Наименование задачи

Лабораторная работа №2. Сортировки.

## Словесное описание

Разработка программы с графическим интерфейсом для сортировки массивов, соответствующая следующим требованиям:

­­­– Поддержка пяти видов сортировки, таких как: поразрядная, вставками, пузырьковая, шейкер и быстрая.

– Наличие поля для ввода массива или же возможность выбрать массивы, представленные в подготовительных документах к данной лабораторной работе.

– Таймер, показывающий время, затраченное на сортировку массива.

## Внешние спецификации функций программы

Программа должна сортировать 3 вида массива 5 способами сортировки, выводить отсортированный массив, а также показывать время, которое было затрачено на выполнения сортировки. Должна быть реализована очистка полей, вывод справочной информации о программе.

Внешние спецификации данных

| Объект программы | Имя объекта в программе | Тип данных | Диапазоны представления | Простая  или  структура | Вход / выход  Константа |
| --- | --- | --- | --- | --- | --- |
| Целое число | arr | long | От  −2 147 483 648  до  2 147 483 647 | Структура | Вход |

## Математическая формулировка задачи

Пользователь взаимодействует с тремя видами массивов, которые в программе хранятся, как массивы типа данных long в виду своей большой длины. В программе реализовано пять видов сортировки:

– Поразрядная

– Вставками

– Пузырьком

– Шейкер

– Быстрая

Сортировки реализованы по принципу вложенных циклов.

## Спецификация интерфейса

Для написания графического интерфейса была использована библиотека Windows Forms.

Плюсы интерфейса заключаются в том, что реализованудобный выбор варианта массива и способа его сортировки, при попытке повторгного нажатия во время сортировки происходит блокировка кнопок для того чтобы избежать вылетов программы.

Реализована обработка повторного нажатия ключевых кнопок, что предотвращает некорректный вывод данных.

В приложении предусмотрено встроенное тестирование при запуске программы, и отдельная кнопка для тестирования работоспособности ключевых расчетных функций.

Реализована работа с сортировкой массивов, очистка полей, кнопки, выводящие справочную информацию о работе программы.

## 1.6 Внешние данные тестирования

## Таблица . Тест-кейс №1, выход из приложения

| Идентификатор | | | T01 |
| --- | --- | --- | --- |
| Заголовок | | | Проверка выхода из приложения |
| Предусловие | | | Приложение не запущено |
| Ожидаемый результат | | | Успешный выход из приложения |
| Шаг | Действие | Предполагаемый результат | Pass/Fail |
| 1 | Запуск UniLab1.exe | Открытие главного окна приложения | Pass |
| 2 | Нажатие на кнопку «Выход» | Выход из приложения | Pass |
| Результат | | | Pass |

## Таблица 2. Тест-кейс №2, запуск сортировки

| Идентификатор | | | T02 |
| --- | --- | --- | --- |
| Заголовок | | | Проверка запуска сортировки |
| Предусловие | | | Приложение запущено |
| Ожидаемый результат | | | Успешный выполнение сортировки |
| Шаг | Действие | Предполагаемый результат | Pass/Fail |
| 1 | Выбор варианта массива | Отображение выбранного массива | Pass |
| 2 | Выбор варианта сортировки | Положительный индикатор на кнопке с выбранной сортировкой | Pass |
| 3 | Нажатие кнопки «Запуск» | Начало сортировки и вывод конечного результата | Pass |
| Результат | | | Pass |

## Таблица 3. Тест-кейс №3, блокировка кнопок

| Идентификатор | | | T03 |
| --- | --- | --- | --- |
| Заголовок | | | Проверка блокировки кнопок во время сортировки |
| Предусловие | | | Приложение запущено |
| Ожидаемый результат | | | Успешный блокировка кнопок |
| Шаг | Действие | Предполагаемый результат | Pass/Fail |
| 1 | Выбор варианта массива | Отображение выбранного массива | Pass |
| 2 | Выбор варианта сортировки | Положительный индикатор на кнопке с выбранной сортировкой | Pass |
| 3 | Нажатие кнопки Запуск | Начало сортировки массива | Pass |
| 4 | Неоднократное нажатие по кнопкам интерфейса программы | Игнорирование нажатий на кнопки | Pass |
| Результат | | | Pass |

## Таблица 4. Тест-кейс №4, очистка полей

| Идентификатор | | | T04 |
| --- | --- | --- | --- |
| Заголовок | | | Проверка очистки полей, после нажатия кнопки Сброс |
| Предусловие | | | Приложение запущено |
| Ожидаемый результат | | | Успешная очистка полей |
| Шаг | Действие | Предполагаемый результат | Pass/Fail |
| 1 | Выбор массива и варианта сортировки | Отображение выбранного массива и положительный индикатор на кнопке с выбранной сортировкой | Pass |
| 2 | Нажатие на кнопку «Сброс» | Очистка всех полей и выбранных вариантов кнопок | Pass |
| Результат | | | Pass |

## Таблица 5. Тест-кейс №5, запуск тестирования

| Идентификатор | | | T05 |
| --- | --- | --- | --- |
| Заголовок | | | Проверка кнопки информации о программе |
| Предусловие | | | Приложение запущено |
| Ожидаемый результат | | | Успешная открытие информационного окна |
| Шаг | Действие | Предполагаемый результат | Pass/Fail |
| 1 | Нажатие на кнопку «Информация» | Отображение окна информации о работе с программой | Pass |
| Результат | | | Pass |

## 1.7 Пример работающей программы

Руководство пользователя и алгоритм работы с программой встроено в приложение.

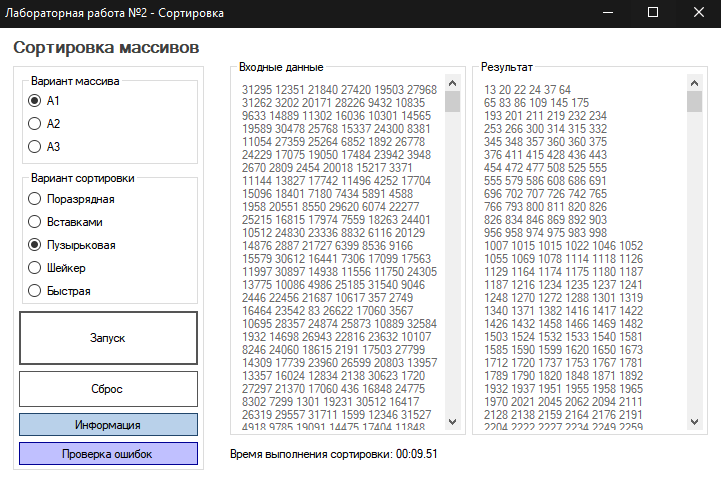


Рисунок 1 – Интерфейс программы

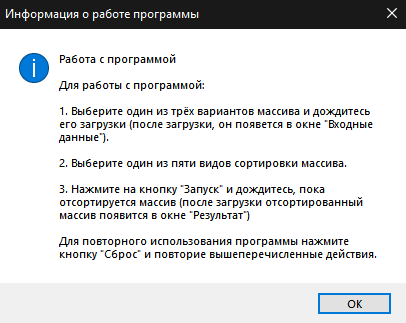


Рисунок 2 – Информационное окно

# 2. Проектирование задачи

Реализовать приложение с графическим интерфейсом, используя библиотеку Windows Forms, для работы с сортировками. Встроенное тестирование, при помощи процедур и функций, проводимое при нажатии отдельной кнопки.

# 2.1 Наименование программы

Программа имеет название UniLab2.exe.

# 2.2 Уточненное словесное описание задачи

Написать код программы и графический интерфейс, в котором можно анализировать работу сортировок. Для трёх вариантов массивов, представленных в методических материалах данной работы, нужно реализовать работу пяти видов сортировок. Нужно создать меню выбора массива и способа сортировки, сделать окна вывода изначального и отсортированного массивов. По мимо этого отобразить время, за которое был отсортирован массив. Реализовать кнопки сброса, тестирования и краткой информации о программе.

# 2.3 Выбор метода решения поставленной задачи

Программа сортировок работает следующим образом: для начала выбирается один из загруженных в программу массивов. Его значения записываются в общий массив, который используется для работы сортировки. После выбора метода сортировки и нажатия кнопки «Запуск» начинается сортировка массива. Фцнкция выбранной сортировки принимает на вход общий массив, заполненный значениями выбранного пользователем варианта и после чего, происходит сортировка одним из выбранных 5 вариантов, названия которых упоминались в отчёте выше. Сами сортировки реализованы по принципу вложенных циклов.

При нажатии кнопки «Сброс» значения всех полей, измененных пользователем и программой во время выполнения сортировки, будут изменены на значения по умолчанию.

Кнопки «Информация» выводят на экран всплывающее окно, в котором описан алгоритм работы с программой.

Кнопка «Проверка ошибок» тестирует определенные функции на соответствие с ожидаемым результатом.

# Уточненные глобальные данные программы

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Объект программы | Имя | Характеристики | | | Назначение |
| Тип данных | Диапазон значений | Тип функции |
| MainForm.h | arr | long | От  −2 147 483 648  до  2 147 483 647 | Структура | Массив для сортировки |

# Декомпозиция функций

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Назначение | Имя | Параметры | | Процедура  Или функция | Включена в  проверку |
| Вход: тип | Выход: тип |
| Функция обновления таймера | UpdateTimer | string | void | Функция | Нет |
| Функция изменения состояния кнопок | SetButtonsState | bool | void | Функция | Нет |
| Функция блокировки кнопок | btnLocker | void | void | Функция | Нет |
| Функция разблокировки кнопок | btnUnlocker | void | void | Функция | Нет |
| Функция для заполнения и отображения массива | LoadArray | long | void | Функция | Нет |
| Функция сортировки с выводом результата | SortAndDisplay | long | void | Функция | Нет |
| Сортировка Поразрядная | radixSort | long | void | Функция | Да |
| Сортировка Вставками | insertionSort | long | void | Функция | Да |
| Сортировка Пузырьком | bubbleSort | long | void | Функция | Да |
| Сорировка Шейкер | shakerSort | long | void | Функция | Да |
| Основная функция быстрой сортировки | quickSort | long | void | Функция | Да |
| Алгоритм сравнивания разрядов | partition | long | void | Функция | Да |
| Кнопка выбора первого массива | arrType1Btn\_CheckedChanged | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка выбора второго массива | arrType2Btn\_CheckedChanged | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка выбора третьего массива | arrType3Btn\_CheckedChanged | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка запуска сортировки | runBtn\_Click | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка сброса данных | resetBtn\_Click | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка открытия окна информации о программе | infoBtn\_Click | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Кнопка тестирования программы | testBtn\_Click | System::Object^ sender, System::EventArgs^ e | System::Void | Процедура | Нет |
| Проверка поразрядной сортировки | test1 | void | int | Функция | Нет |
| Проверка сортировки вставками | test2 | void | int | Функция | Нет |
| Проверка сортировки пузырьком | test3 | void | int | Функция | Нет |
| Проверка шейкер сортировки | test4 | void | int | Функция | Нет |
| Проверка быстрой сортировки | test5 | void | int | Функция | Нет |

# Блок-схемы:

– Блок-схема функции radixSort в Приложении A;

– Блок-схема функции insertionSort в Приложении Б;

– Блок-схема функции bubbleSort в Приложении В;

– Блок-схема процедуры shakerSort в Приложении Г;

– Блок-схема процедуры quickSort в Приложении Д.

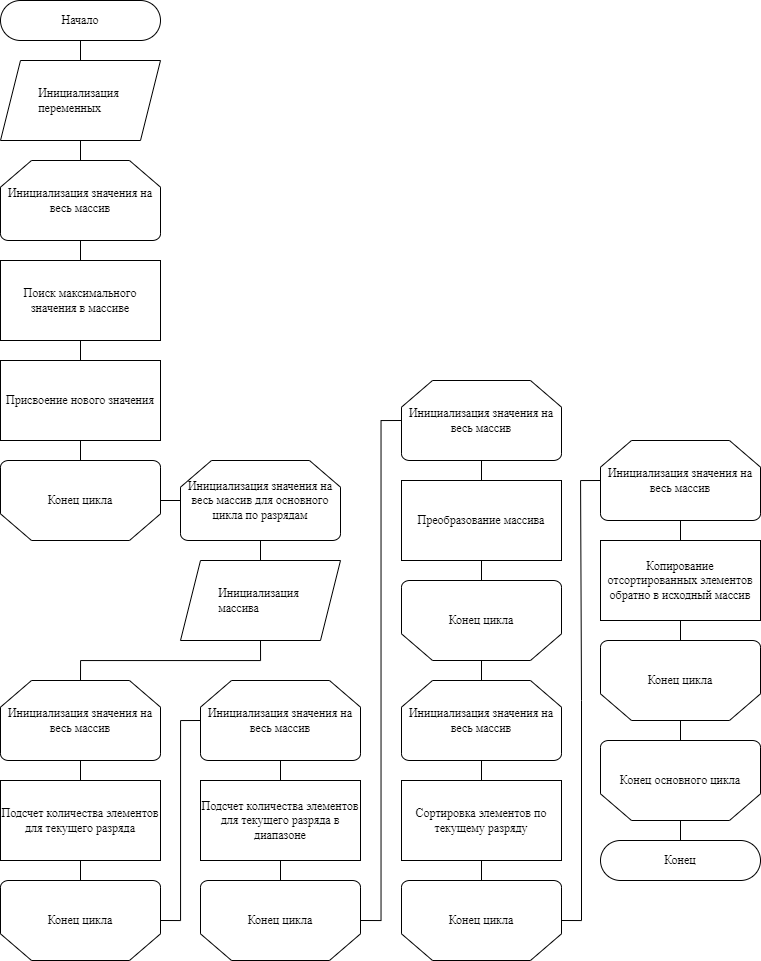
# Алгоритмизация:

– Листинг файла UniLab2.h в Приложение Е;

– Листинг файла MainForm.cpp в Приложение Ж.

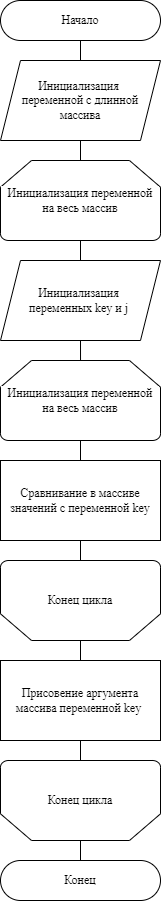
# Приложение А

Блок-схема функции radixSort



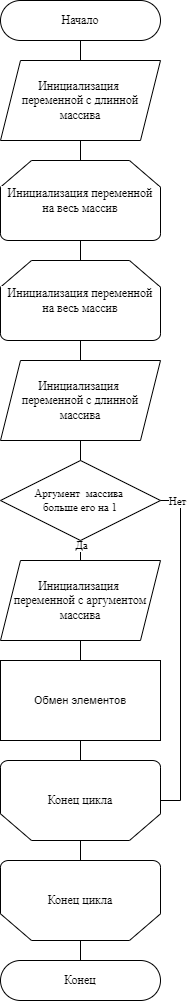
# Приложение Б

# Блок-схема функции insertionSort



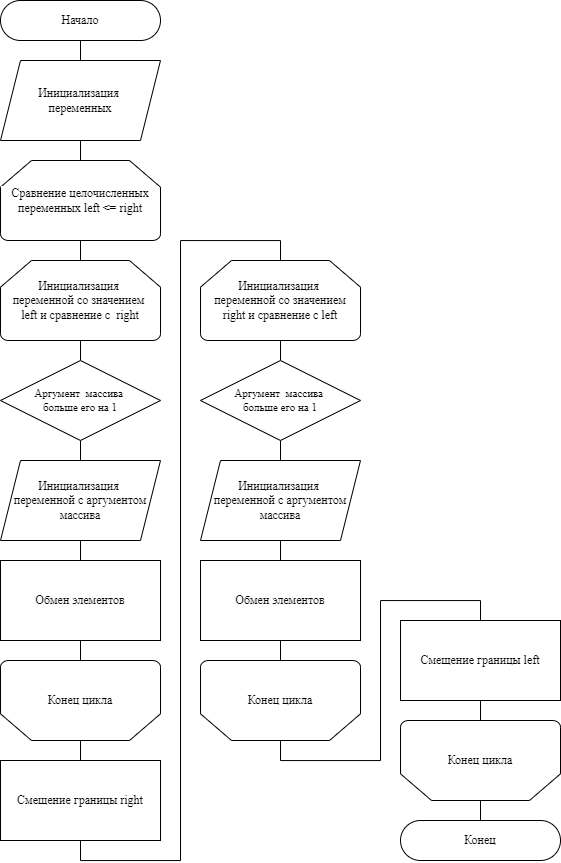
# Приложение В

# Блок-схема функции bubbleSort



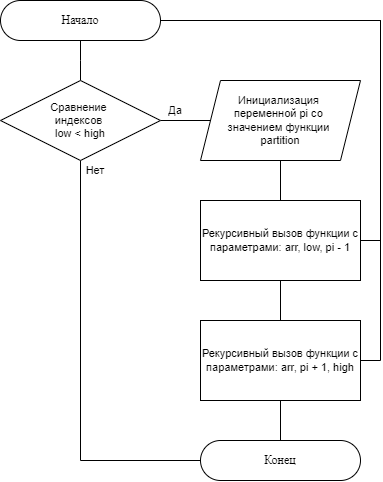
# Приложение Г

# Блок-схема процедуры shakerSort



# Приложение Д

# Блок-схема процедуры quickSort



# Приложение Е

# Листинг программы, файл UniLab2.h

#pragma once

#include <iostream>

namespace UniLab2 {

using namespace System;

using namespace System::Text;

using namespace System::ComponentModel;

using namespace System::Collections;

using namespace System::Windows::Forms;

using namespace System::Data;

using namespace System::Drawing;

/// <summary>

/// Summary for MainForm

/// </summary>

public ref class MainForm : public System::Windows::Forms::Form

{

private: System::DateTime startTime;

private: System::DateTime endTime;

private: System::Windows::Forms::Timer^ timer;

public:

MainForm(void)

{

InitializeComponent();

timer = gcnew System::Windows::Forms::Timer();

timer->Interval = 1000;

timer->Tick += gcnew System::EventHandler(this, &MainForm::UpdateTimer);

}

protected:

/// <summary>

/// Clean up any resources being used.

/// </summary>

~MainForm()

{

if (components)

{

delete components;

}

}

private: array<long>^ arr; // Массив, который принимает один из выбранных вариантов и используется для сортировки и вывода результата

private: System::Windows::Forms::Label^ nameLabel;

private: System::Windows::Forms::RadioButton^ arrType1Btn;

private: System::Windows::Forms::RadioButton^ arrType2Btn;

private: System::Windows::Forms::RadioButton^ arrType3Btn;

private: System::Windows::Forms::RadioButton^ radixSortBtn;

private: System::Windows::Forms::RadioButton^ insertionSortBtn;

private: System::Windows::Forms::RadioButton^ bubbleSortBtn;

private: System::Windows::Forms::RadioButton^ shakerSortBtn;

private: System::Windows::Forms::RadioButton^ quickSortBtn;

private: System::Windows::Forms::Button^ runBtn;

private: System::Windows::Forms::Button^ resetBtn;

private: System::Windows::Forms::GroupBox^ groupBox1;

private: System::Windows::Forms::Button^ infoBtn;

private: System::Windows::Forms::Button^ testBtn;

private: System::Windows::Forms::GroupBox^ groupBox4;

private: System::Windows::Forms::GroupBox^ groupBox5;

private: System::Windows::Forms::Label^ timerLabel;

private: System::Windows::Forms::Panel^ panel1;

private: System::Windows::Forms::Label^ inputLabel;

private: System::Windows::Forms::GroupBox^ groupBox2;

private: System::Windows::Forms::GroupBox^ groupBox3;

private: System::Windows::Forms::Panel^ panel2;

private: System::Windows::Forms::Label^ outputLabel;

private:

/// <summary>

/// Required designer variable.

/// </summary>

System::ComponentModel::Container^ components;

#pragma region Windows Form Designer generated code

/// <summary>

/// Required method for Designer support - do not modify

/// the contents of this method with the code editor.

/// </summary>

void InitializeComponent(void)

{

this->nameLabel = (gcnew System::Windows::Forms::Label());

this->arrType1Btn = (gcnew System::Windows::Forms::RadioButton());

this->arrType2Btn = (gcnew System::Windows::Forms::RadioButton());

this->arrType3Btn = (gcnew System::Windows::Forms::RadioButton());

this->radixSortBtn = (gcnew System::Windows::Forms::RadioButton());

this->insertionSortBtn = (gcnew System::Windows::Forms::RadioButton());

this->bubbleSortBtn = (gcnew System::Windows::Forms::RadioButton());

this->shakerSortBtn = (gcnew System::Windows::Forms::RadioButton());

this->quickSortBtn = (gcnew System::Windows::Forms::RadioButton());

this->runBtn = (gcnew System::Windows::Forms::Button());

this->resetBtn = (gcnew System::Windows::Forms::Button());

this->groupBox1 = (gcnew System::Windows::Forms::GroupBox());

this->groupBox5 = (gcnew System::Windows::Forms::GroupBox());

this->groupBox4 = (gcnew System::Windows::Forms::GroupBox());

this->testBtn = (gcnew System::Windows::Forms::Button());

this->infoBtn = (gcnew System::Windows::Forms::Button());

this->timerLabel = (gcnew System::Windows::Forms::Label());

this->panel1 = (gcnew System::Windows::Forms::Panel());

this->inputLabel = (gcnew System::Windows::Forms::Label());

this->groupBox2 = (gcnew System::Windows::Forms::GroupBox());

this->groupBox3 = (gcnew System::Windows::Forms::GroupBox());

this->panel2 = (gcnew System::Windows::Forms::Panel());

this->outputLabel = (gcnew System::Windows::Forms::Label());

this->groupBox1->SuspendLayout();

this->groupBox5->SuspendLayout();

this->groupBox4->SuspendLayout();

this->panel1->SuspendLayout();

this->groupBox2->SuspendLayout();

this->groupBox3->SuspendLayout();

this->panel2->SuspendLayout();

this->SuspendLayout();

//

// nameLabel

//

this->nameLabel->AutoSize = true;

this->nameLabel->Font = (gcnew System::Drawing::Font(L"Microsoft Sans Serif", 12, System::Drawing::FontStyle::Bold, System::Drawing::GraphicsUnit::Point,

static\_cast<System::Byte>(204)));

this->nameLabel->ForeColor = System::Drawing::Color::FromArgb(static\_cast<System::Int32>(static\_cast<System::Byte>(64)), static\_cast<System::Int32>(static\_cast<System::Byte>(64)),

static\_cast<System::Int32>(static\_cast<System::Byte>(64)));

this->nameLabel->Location = System::Drawing::Point(12, 9);

this->nameLabel->Name = L"nameLabel";

this->nameLabel->Size = System::Drawing::Size(195, 20);

this->nameLabel->TabIndex = 0;

this->nameLabel->Text = L"Сортировка массивов";

//

// arrType1Btn

//

this->arrType1Btn->AutoSize = true;

this->arrType1Btn->Location = System::Drawing::Point(6, 18);

this->arrType1Btn->Name = L"arrType1Btn";

this->arrType1Btn->Size = System::Drawing::Size(38, 17);

this->arrType1Btn->TabIndex = 2;

this->arrType1Btn->Text = L"A1";

this->arrType1Btn->UseVisualStyleBackColor = true;

this->arrType1Btn->CheckedChanged += gcnew System::EventHandler(this, &MainForm::arrType1Btn\_CheckedChanged);

//

// arrType2Btn

//

this->arrType2Btn->AutoSize = true;

this->arrType2Btn->Location = System::Drawing::Point(6, 41);

this->arrType2Btn->Name = L"arrType2Btn";

this->arrType2Btn->Size = System::Drawing::Size(38, 17);

this->arrType2Btn->TabIndex = 3;

this->arrType2Btn->Text = L"A2";

this->arrType2Btn->UseVisualStyleBackColor = true;

this->arrType2Btn->CheckedChanged += gcnew System::EventHandler(this, &MainForm::arrType2Btn\_CheckedChanged);

//

// arrType3Btn

//

this->arrType3Btn->AutoSize = true;

this->arrType3Btn->Location = System::Drawing::Point(6, 64);

this->arrType3Btn->Name = L"arrType3Btn";

this->arrType3Btn->Size = System::Drawing::Size(38, 17);

this->arrType3Btn->TabIndex = 4;

this->arrType3Btn->Text = L"A3";

this->arrType3Btn->UseVisualStyleBackColor = true;

this->arrType3Btn->CheckedChanged += gcnew System::EventHandler(this, &MainForm::arrType3Btn\_CheckedChanged);

//

// radixSortBtn

//

this->radixSortBtn->AutoSize = true;

this->radixSortBtn->Location = System::Drawing::Point(6, 19);

this->radixSortBtn->Name = L"radixSortBtn";

this->radixSortBtn->Size = System::Drawing::Size(93, 17);

this->radixSortBtn->TabIndex = 6;

this->radixSortBtn->Text = L"Поразрядная";

this->radixSortBtn->UseVisualStyleBackColor = true;

//

// insertionSortBtn

//

this->insertionSortBtn->AutoSize = true;

this->insertionSortBtn->Location = System::Drawing::Point(6, 42);

this->insertionSortBtn->Name = L"insertionSortBtn";

this->insertionSortBtn->Size = System::Drawing::Size(81, 17);

this->insertionSortBtn->TabIndex = 7;

this->insertionSortBtn->Text = L"Вставками";

this->insertionSortBtn->UseVisualStyleBackColor = true;

//

// bubbleSortBtn

//

this->bubbleSortBtn->AutoSize = true;

this->bubbleSortBtn->Location = System::Drawing::Point(6, 65);

this->bubbleSortBtn->Name = L"bubbleSortBtn";

this->bubbleSortBtn->Size = System::Drawing::Size(94, 17);

this->bubbleSortBtn->TabIndex = 8;

this->bubbleSortBtn->Text = L"Пузырьковая";

this->bubbleSortBtn->UseVisualStyleBackColor = true;

//

// shakerSortBtn

//

this->shakerSortBtn->AutoSize = true;

this->shakerSortBtn->Location = System::Drawing::Point(6, 88);

this->shakerSortBtn->Name = L"shakerSortBtn";

this->shakerSortBtn->Size = System::Drawing::Size(64, 17);

this->shakerSortBtn->TabIndex = 9;

this->shakerSortBtn->Text = L"Шейкер";

this->shakerSortBtn->UseVisualStyleBackColor = true;

//

// quickSortBtn

//

this->quickSortBtn->AutoSize = true;

this->quickSortBtn->Location = System::Drawing::Point(6, 111);

this->quickSortBtn->Name = L"quickSortBtn";

this->quickSortBtn->Size = System::Drawing::Size(69, 17);

this->quickSortBtn->TabIndex = 10;

this->quickSortBtn->Text = L"Быстрая";

this->quickSortBtn->UseVisualStyleBackColor = true;

//

// runBtn

//

this->runBtn->BackColor = System::Drawing::SystemColors::ButtonHighlight;

this->runBtn->FlatStyle = System::Windows::Forms::FlatStyle::Popup;

this->runBtn->Location = System::Drawing::Point(6, 251);

this->runBtn->Name = L"runBtn";

this->runBtn->Size = System::Drawing::Size(179, 54);

this->runBtn->TabIndex = 11;

this->runBtn->TabStop = false;

this->runBtn->Text = L"Запуск";

this->runBtn->UseVisualStyleBackColor = false;

this->runBtn->Click += gcnew System::EventHandler(this, &MainForm::runBtn\_Click);

//

// resetBtn

//

this->resetBtn->BackColor = System::Drawing::SystemColors::ButtonHighlight;

this->resetBtn->FlatStyle = System::Windows::Forms::FlatStyle::Popup;

this->resetBtn->Location = System::Drawing::Point(6, 311);

this->resetBtn->Name = L"resetBtn";

this->resetBtn->Size = System::Drawing::Size(179, 36);

this->resetBtn->TabIndex = 12;

this->resetBtn->TabStop = false;

this->resetBtn->Text = L"Сброс";

this->resetBtn->UseVisualStyleBackColor = false;

this->resetBtn->Click += gcnew System::EventHandler(this, &MainForm::resetBtn\_Click);

//

// groupBox1

//

this->groupBox1->BackColor = System::Drawing::SystemColors::ButtonHighlight;

this->groupBox1->Controls->Add(this->groupBox5);

this->groupBox1->Controls->Add(this->groupBox4);

this->groupBox1->Controls->Add(this->resetBtn);

this->groupBox1->Controls->Add(this->testBtn);

this->groupBox1->Controls->Add(this->infoBtn);

this->groupBox1->Controls->Add(this->runBtn);

this->groupBox1->Location = System::Drawing::Point(16, 32);

this->groupBox1->Name = L"groupBox1";

this->groupBox1->Size = System::Drawing::Size(191, 411);

this->groupBox1->TabIndex = 13;

this->groupBox1->TabStop = false;

//

// groupBox5

//

this->groupBox5->Controls->Add(this->arrType2Btn);

this->groupBox5->Controls->Add(this->arrType3Btn);

this->groupBox5->Controls->Add(this->arrType1Btn);

this->groupBox5->Location = System::Drawing::Point(9, 14);

this->groupBox5->Name = L"groupBox5";

this->groupBox5->Size = System::Drawing::Size(176, 91);

this->groupBox5->TabIndex = 0;

this->groupBox5->TabStop = false;

this->groupBox5->Text = L"Вариант массива";

//

// groupBox4

//

this->groupBox4->Controls->Add(this->insertionSortBtn);

this->groupBox4->Controls->Add(this->radixSortBtn);

this->groupBox4->Controls->Add(this->bubbleSortBtn);

this->groupBox4->Controls->Add(this->shakerSortBtn);

this->groupBox4->Controls->Add(this->quickSortBtn);

this->groupBox4->Location = System::Drawing::Point(9, 111);

this->groupBox4->Name = L"groupBox4";

this->groupBox4->Size = System::Drawing::Size(176, 134);

this->groupBox4->TabIndex = 0;

this->groupBox4->TabStop = false;

this->groupBox4->Text = L"Вариант сортировки";

//

// testBtn

//

this->testBtn->BackColor = System::Drawing::Color::FromArgb(static\_cast<System::Int32>(static\_cast<System::Byte>(192)), static\_cast<System::Int32>(static\_cast<System::Byte>(192)),

static\_cast<System::Int32>(static\_cast<System::Byte>(255)));

this->testBtn->FlatStyle = System::Windows::Forms::FlatStyle::Popup;

this->testBtn->Location = System::Drawing::Point(6, 382);

this->testBtn->Name = L"testBtn";

this->testBtn->Size = System::Drawing::Size(179, 23);

this->testBtn->TabIndex = 14;

this->testBtn->TabStop = false;

this->testBtn->Text = L"Проверка ошибок";

this->testBtn->UseVisualStyleBackColor = false;

this->testBtn->Enabled = true;

this->testBtn->Click += gcnew System::EventHandler(this, &MainForm::testBtn\_Click);

//

// infoBtn

//

this->infoBtn->BackColor = System::Drawing::SystemColors::GradientActiveCaption;

this->infoBtn->FlatStyle = System::Windows::Forms::FlatStyle::Popup;

this->infoBtn->ForeColor = System::Drawing::SystemColors::ActiveCaptionText;

this->infoBtn->Location = System::Drawing::Point(6, 353);

this->infoBtn->Name = L"infoBtn";

this->infoBtn->Size = System::Drawing::Size(179, 23);

this->infoBtn->TabIndex = 13;

this->infoBtn->TabStop = false;

this->infoBtn->Text = L"Информация";

this->infoBtn->UseVisualStyleBackColor = false;

this->infoBtn->Click += gcnew System::EventHandler(this, &MainForm::infoBtn\_Click);

//

// timerLabel

//

this->timerLabel->AutoSize = true;

this->timerLabel->Location = System::Drawing::Point(230, 419);

this->timerLabel->Name = L"timerLabel";

this->timerLabel->Size = System::Drawing::Size(170, 13);

this->timerLabel->TabIndex = 16;

this->timerLabel->Text = L"Время выполнения сортировки:";

//

// panel1

//

this->panel1->AutoScroll = true;

this->panel1->Controls->Add(this->inputLabel);

this->panel1->Location = System::Drawing::Point(6, 14);

this->panel1->Name = L"panel1";

this->panel1->Size = System::Drawing::Size(225, 356);

this->panel1->TabIndex = 17;

//

// inputLabel

//

this->inputLabel->AutoSize = true;

this->inputLabel->ForeColor = System::Drawing::SystemColors::ControlDarkDark;

this->inputLabel->Location = System::Drawing::Point(3, 9);

this->inputLabel->Name = L"inputLabel";

this->inputLabel->Size = System::Drawing::Size(208, 26);

this->inputLabel->TabIndex = 0;

this->inputLabel->Text = L"Здесь будет отображаться выбранный \r\nвами неотсортированный массив";

//

// groupBox2

//

this->groupBox2->Controls->Add(this->panel1);

this->groupBox2->Location = System::Drawing::Point(233, 32);

this->groupBox2->Name = L"groupBox2";

this->groupBox2->Size = System::Drawing::Size(236, 376);

this->groupBox2->TabIndex = 18;

this->groupBox2->TabStop = false;

this->groupBox2->Text = L"Входные данные";

//

// groupBox3

//

this->groupBox3->Controls->Add(this->panel2);

this->groupBox3->Location = System::Drawing::Point(475, 32);

this->groupBox3->Name = L"groupBox3";

this->groupBox3->Size = System::Drawing::Size(236, 376);

this->groupBox3->TabIndex = 19;

this->groupBox3->TabStop = false;

this->groupBox3->Text = L"Результат";

//

// panel2

//

this->panel2->AutoScroll = true;

this->panel2->Controls->Add(this->outputLabel);

this->panel2->Location = System::Drawing::Point(6, 14);

this->panel2->Name = L"panel2";

this->panel2->Size = System::Drawing::Size(225, 356);

this->panel2->TabIndex = 17;

//

// outputLabel

//

this->outputLabel->AutoSize = true;

this->outputLabel->ForeColor = System::Drawing::SystemColors::ControlDarkDark;

this->outputLabel->Location = System::Drawing::Point(3, 9);

this->outputLabel->Name = L"outputLabel";

this->outputLabel->Size = System::Drawing::Size(208, 26);

this->outputLabel->TabIndex = 0;

this->outputLabel->Text = L"Здесь будет отображаться выбранный \r\nвами массив в отсортированном виде";

//

// MainForm

//

this->AutoScaleDimensions = System::Drawing::SizeF(6, 13);

this->AutoScaleMode = System::Windows::Forms::AutoScaleMode::Font;

this->BackColor = System::Drawing::SystemColors::Window;

this->ClientSize = System::Drawing::Size(725, 455);

this->Controls->Add(this->groupBox3);

this->Controls->Add(this->groupBox2);

this->Controls->Add(this->timerLabel);

this->Controls->Add(this->groupBox1);

this->Controls->Add(this->nameLabel);

this->Name = L"MainForm";

this->ShowIcon = false;

this->StartPosition = System::Windows::Forms::FormStartPosition::CenterScreen;

this->Text = L"Лабораторная работа №2 - Сортировка";

this->groupBox1->ResumeLayout(false);

this->groupBox5->ResumeLayout(false);

this->groupBox5->PerformLayout();

this->groupBox4->ResumeLayout(false);

this->groupBox4->PerformLayout();

this->panel1->ResumeLayout(false);

this->panel1->PerformLayout();

this->groupBox2->ResumeLayout(false);

this->groupBox3->ResumeLayout(false);

this->panel2->ResumeLayout(false);

this->panel2->PerformLayout();

this->ResumeLayout(false);

this->PerformLayout();

}

#pragma endregion

// -- [ Функции ] --

// Функция обновления таймера

private: void UpdateTimer(Object^ sender, EventArgs^ e)

{

TimeSpan elapsedTime = endTime - startTime;

timerLabel->Text = "Время выполнения сортировки: " + elapsedTime.ToString("mm\\:ss\\.ff");

}

// Функция изменения состояния кнопок

private: void SetButtonsState(bool enabled) {

this->SuspendLayout();

this->arrType1Btn->Enabled = enabled;

this->arrType2Btn->Enabled = enabled;

this->arrType3Btn->Enabled = enabled;

this->radixSortBtn->Enabled = enabled;

this->insertionSortBtn->Enabled = enabled;

this->bubbleSortBtn->Enabled = enabled;

this->shakerSortBtn->Enabled = enabled;

this->quickSortBtn->Enabled = enabled;

this->runBtn->Enabled = enabled;

this->resetBtn->Enabled = enabled;

this->infoBtn->Enabled = enabled;

this->testBtn->Enabled = enabled;

this->ResumeLayout();

}

// Функция блокировки кнопок

private: void btnLocker() {

SetButtonsState(false);

}

// Функция разблокировки кнопок

private: void btnUnlocker() {

SetButtonsState(true);

}

// Функция для заполнения и отображения массива

private: void LoadArray(long mass[], int length) {

btnLocker();

this->inputLabel->Text = "";

this->outputLabel->Text = "";

arr = gcnew array<long>(length);

System::Text::StringBuilder^ sb = gcnew System::Text::StringBuilder();

for (int i = 0; i < length; i++) {

arr[i] = mass[i];

sb->Append(mass[i].ToString() + " ");

if ((i + 1) % 6 == 0) {

sb->Append("\n");

}

}

this->inputLabel->Text = sb->ToString();

btnUnlocker();

}

// Функция сортировки с выводом результата

private:void SortAndDisplay(array<long>^ arr, Action<array<long>^>^ sortMethod) {

startTime = System::DateTime::Now;

btnLocker();

sortMethod(arr);

this->outputLabel->Text = "";

for (int i = 0; i < arr->Length; ++i) {

this->outputLabel->Text += arr[i].ToString() + " ";

if ((i + 1) % 6 == 0) {

this->outputLabel->Text += "\n";

}

}

btnUnlocker();

endTime = System::DateTime::Now;

TimeSpan elapsedTime = endTime - startTime;

timerLabel->Text = "Время выполнения сортировки: " + elapsedTime.ToString("mm\\:ss\\.ff");

}

// -- [ Сортировки ] --

// Сортировка Поразрядная

void radixSort(array<long>^ arr) {

int n = arr->Length;

array<long>^ output = gcnew array<long>(n);

long max = arr[0];

for (int i = 1; i < n; i++) {

if (arr[i] > max)

max = arr[i];

}

for (long exp = 1; max / exp > 0; exp \*= 10) {

array<int>^ count = gcnew array<int>(10);

for (int i = 0; i < 10; i++)

count[i] = 0;

for (int i = 0; i < n; i++)

count[(arr[i] / exp) % 10]++;

for (int i = 1; i < 10; i++)

count[i] += count[i - 1];

for (int i = n - 1; i >= 0; i--) {

output[count[(arr[i] / exp) % 10] - 1] = arr[i];

count[(arr[i] / exp) % 10]--;

}

for (int i = 0; i < n; i++)

arr[i] = output[i];

}

}

// Сортировка Вставками

void insertionSort(array<long>^ arr) {

int n = arr->Length;

for (int i = 1; i < n; i++) {

long key = arr[i];

int j = i - 1;

while (j >= 0 && arr[j] > key) {

arr[j + 1] = arr[j];

j--;

}

arr[j + 1] = key;

}

}

// Сортировка Пузырьком

void bubbleSort(array<long>^ arr) {

int n = arr->Length;

for (int i = 0; i < n - 1; i++) {

for (int j = 0; j < n - i - 1; j++) {

if (arr[j] > arr[j + 1]) {

long temp = arr[j];

arr[j] = arr[j + 1];

arr[j + 1] = temp;

}

}

}

}

// Сорировка Шейкер

void shakerSort(array<long>^ arr) {

int n = arr->Length;

int left = 0, right = n - 1;

while (left <= right) {

for (int i = left; i < right; i++) {

if (arr[i] > arr[i + 1]) {

long temp = arr[i];

arr[i] = arr[i + 1];

arr[i + 1] = temp;

}

}

right--;

for (int i = right; i > left; i--) {

if (arr[i] < arr[i - 1]) {

long temp = arr[i];

arr[i] = arr[i - 1];

arr[i - 1] = temp;

}

}

left++;

}

}

// Основная функция быстрой сортировки

void quickSort(array<long>^ arr, int low, int high) {

if (low < high) {

int pi = partition(arr, low, high);

quickSort(arr, low, pi - 1);

quickSort(arr, pi + 1, high);

}

}

// Перегрузка функции быстрой сортировки для вызова без параметров low и high

void quickSort(array<long>^ arr) {

quickSort(arr, 0, arr->Length - 1);

}

// Алгоритм сравнивания разрядов

int partition(array<long>^ arr, int low, int high) {

long pivot = arr[high];

int i = low - 1;

for (int j = low; j <= high - 1; j++) {

if (arr[j] < pivot) {

i++;

long temp = arr[i];

arr[i] = arr[j];

arr[j] = temp;

}

}

long temp = arr[i + 1];

arr[i + 1] = arr[high];

arr[high] = temp;

return i + 1;

}

// -- [ Кнопки ] --

// Кнопка выбора первого массива

private: System::Void arrType1Btn\_CheckedChanged(System::Object^ sender, System::EventArgs^ e) {

long massA1[] = { 31295, 12351, 21840, 27420, 19503, 27968, 31262, 3202, 20171, 28226, 9432, 10835, 9633, 14889, 11302, 16036, 10301, 14565, 19589, 30478, 25768, 15337, 24300, 8381, 11054, 27359, 25264, 6852, 1892, 26778, 24229, 17075, 19050, 17484, 23942, 3948, 2670, 2809, 2454, 20018, 15217, 3371, 11144, 13827, 17742, 11496, 4252, 17704, 15096, 18401, 7180, 7434, 5891, 4588, 1958, 20551, 8550, 29620, 6074, 22277, 25215, 16815, 17974, 7559, 18263, 24401, 10512, 24830, 23336, 8832, 6116, 20129, 14876, 2887, 21727, 6399, 8536, 9166, 15579, 30612, 16441, 7306, 17099, 17563, 11997, 30897, 14938, 11556, 11750, 24305, 13775, 10086, 4986, 25185, 31540, 9046, 2446, 22456, 21687, 10617, 357, 2749, 16464, 23542, 83, 26622, 17060, 3567, 10695, 28357, 24874, 25873, 10889, 32584, 1932, 14698, 26943, 22816, 23632, 10107, 8246, 24060, 18615, 2191, 17503, 27799, 14309, 17739, 23960, 26599, 20803, 13957, 13357, 16024, 12834, 2138, 30623, 1720, 27297, 21370, 17060, 436, 16848, 24775, 8302, 7299, 1301, 19231, 30512, 16417, 26319, 29557, 31711, 1599, 12346, 31527, 4918, 9785, 19091, 14475, 17404, 11848, 25468, 22987, 7817, 23801, 12449, 10740, 15751, 11997, 5788, 11337, 17398, 29826, 14102, 477, 31858, 1187, 10799, 19809, 32185, 24220, 26400, 2362, 30824, 20768, 8223, 983, 4613, 31022, 5508, 30273, 28994, 11585, 9257, 26867, 24448, 10440, 4886, 23277, 9107, 3029, 25694, 24324, 31173, 793, 11588, 9084, 19741, 11280, 14754, 6104, 5601, 2425, 32396, 9457, 345, 7177, 8240, 11078, 18134, 29536, 3840, 15251, 19955, 19260, 20, 15781, 2587, 2285, 17609, 31084, 12107, 11529, 17839, 13906, 9241, 3424, 9378, 25803, 21750, 27442, 18998, 1581, 19632, 14752, 25177, 18115, 13883, 10337, 3123, 32284, 11184, 18102, 16721, 2473, 30358, 21152, 14339, 13704, 9569, 2128, 17666, 10138, 6712, 1503, 86, 219, 30459, 5951, 12663, 10483, 2693, 32370, 18099, 30728, 9006, 3065, 23503, 13015, 27284, 7056, 5105, 3331, 11932, 18712, 19134, 9644, 15283, 29141, 24767, 12868, 11354, 21977, 9993, 19358, 20961, 28096, 11805, 4424, 6770, 18590, 31757, 5915, 6226, 1590, 28128, 20752, 3684, 16749, 18488, 29014, 9711, 32510, 15154, 27809, 12704, 29806, 23950, 6340, 8659, 15171, 25360, 6530, 3598, 17521, 4645, 4001, 30670, 8213, 15562, 15937, 10887, 28005, 16554, 6764, 23782, 1767, 21126, 30958, 30553, 16098, 6362, 20071, 9169, 16403, 22974, 13726, 2759, 26272, 16394, 12312, 24957, 9554, 31677, 21738, 11654, 19198, 16800, 25035, 24968, 15428, 28198, 25197, 14145, 30076, 20375, 25102, 27336, 26862, 23405, 23370, 15125, 3393, 21247, 23091, 21444, 12343, 7004, 1187, 1046, 24983, 19578, 31953, 26425, 2666, 15248, 21027, 25033, 1129, 1216, 29763, 6294, 17847, 22521, 23669, 17576, 29900, 3356, 24872, 2176, 30897, 17245, 26570, 10913, 22899, 4077, 26849, 22863, 1234, 32726, 31320, 23447, 19257, 28966, 21526, 21391, 10483, 1871, 726, 30175, 12187, 16078, 15666, 23168, 9172, 25611, 3840, 19140, 9019, 29056, 20194, 12439, 26266, 6430, 4633, 2820, 29791, 31980, 4762, 3067, 22348, 23282, 15204, 17233, 11631, 12373, 20240, 31496, 9045, 6083, 23722, 10449, 12155, 26385, 30399, 6351, 8709, 20515, 24759, 13726, 23730, 2317, 9829, 4500, 18192, 16247, 20957, 5446, 21228, 23366, 13190, 30542, 9485, 21625, 28784, 24908, 13858, 8272, 19175, 26155, 32760, 31156, 22856, 11686, 2800, 2259, 7955, 30986, 28593, 11787, 15426, 25917, 8474, 29705, 9945, 3583, 4730, 27954, 8895, 30320, 3588, 65, 27596, 23250, 20349, 26674, 17955, 20369, 14136, 27488, 26818, 20864, 10564, 3562, 30295, 11110, 27876, 17242, 30805, 21689, 8255, 25481, 4168, 11689, 5209, 26301, 21350, 15457, 9538, 11541, 1126, 20361, 25230, 21799, 8085, 10767, 7172, 26087, 27942, 7207, 9883, 20427, 3529, 11664, 28066, 2348, 13696, 15641, 9278, 18928, 2222, 14693, 11033, 10854, 20337, 22251, 32345, 10609, 29490, 26432, 16335, 24041, 31355, 13721, 12657, 22334, 30472, 3212, 13323, 29022, 6688, 18710, 7729, 8153, 25382, 7906, 32632, 29763, 7275, 29128, 9190, 25563, 6726, 26773, 27558, 4201, 28775, 7434, 19200, 6253, 4456, 3367, 1673, 12917, 3237, 12713, 32663, 6095, 24142, 24017, 9464, 608, 1466, 19559, 23524, 16852, 22014, 32255, 29999, 11256, 13503, 19579, 707, 27747, 15172, 22481, 8526, 30556, 28111, 12302, 2616, 9208, 32046, 24731, 472, 12675, 18061, 16575, 30183, 15393, 1422, 11622, 24629, 25781, 27804, 4129, 16794, 12290, 6012, 22381, 18736, 24849, 3108, 17464, 31679, 21202, 15825, 12449, 28537, 5381, 18004, 13312, 28648, 20571, 18860, 18470, 7716, 13785, 14298, 21478, 24905, 32126, 24817, 16084, 15144, 14373, 3949, 29260, 21821, 30893, 7365, 27574, 23010, 6230, 13380, 17417, 28097, 6766, 14356, 20622, 23951, 29486, 31900, 16615, 21496, 13791, 19980, 24143, 11221, 28224, 29749, 20515, 12965, 10540, 10399, 2466, 28475, 28792, 13013, 17649, 16564, 15899, 7940, 12129, 27052, 10897, 17092, 10997, 23474, 23169, 1078, 18719, 22264, 28573, 5967, 25291, 12879, 201, 9587, 29086, 24403, 23936, 4934, 3712, 32483, 8308, 22719, 14680, 6613, 21877, 8062, 19990, 20967, 13972, 7007, 19191, 7928, 17544, 20815, 19460, 27768, 15953, 16478, 24541, 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// Кнопка выбора второго массива

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// Кнопка выбора третьего массива

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1191, 1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1459, 1460, 1461, 1462, 1463, 1464, 1465, 1466, 1467, 1468, 1469, 1470, 1471, 1472, 1473, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1493, 1494, 1495, 1496, 1497, 1498, 1499, 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1540, 1541, 1542, 1543, 1544, 1545, 1546, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1567, 1568, 1569, 1570, 1571, 1572, 1573, 1574, 1575, 1576, 1577, 1578, 1579, 1580, 1581, 1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746, 1747, 1748, 1749, 1750, 1751, 1752, 1753, 1754, 1755, 1756, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775, 1776, 1777, 1778, 1779, 1780, 1781, 1782, 1783, 1784, 1785, 1786, 1787, 1788, 1789, 1790, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 20416, 30127, 24171, 16842, 30564, 20005, 24359, 14465, 25282, 28351, 24950, 24699, 19553, 17022, 5289, 6870, 949, 17043, 5753, 12917, 31717, 23063, 6126, 32084, 14290, 12796, 18816, 10264, 14164, 31044, 21117, 24555, 18886, 32112, 22442, 20102, 27078, 10044, 21805, 7311, 1590, 12169, 20394, 28198, 23686, 8347, 8365, 3515, 18486, 30596, 25160, 14626, 11158, 31200, 15869, 17641, 21969, 5059, 8925, 2537, 2601, 20976, 9970, 20763, 3204, 19532, 6107, 12717, 22312, 5266, 32438, 5461, 24003, 32071, 6979, 22246, 430, 19697, 6725, 12065, 7026, 12676, 2860, 25549, 15756, 2077, 22770, 27914, 5229, 19698, 19011, 1250, 1989, 18313, 19680, 21793, 257, 18217, 4165, 14182, 31506, 911, 13194, 15227, 16241, 30177, 2695, 26594, 29792, 15848, 15931, 26800, 24690, 26489, 19567, 8351, 1869, 9268, 10902, 20574, 943, 19826, 4088, 18475, 17071, 17016, 11023, 22436, 1094, 30449, 17969, 28634, 17677, 17819, 8048, 11176, 30024, 23360, 30655, 12867, 8484, 19944, 7510, 10257, 28221, 13389, 30039, 8639, 4707, 20879, 18609, 19854, 10142, 10537, 22596, 18157, 367, 3876, 31815, 18509, 26457, 2186, 21223, 12081, 22688, 4126, 16945, 1668, 15697, 4938, 20786, 2864, 10370, 15193, 7261, 24300, 4059, 22246, 26925, 23893, 7254, 30612, 7435, 18241, 30786, 6144, 7025, 14416, 16014, 24052, 20304, 6852, 28484, 19678, 25519, 3474, 3412, 31872, 28565, 28856, 18835, 10216, 6442, 3026, 24323, 10403, 29721, 744, 1109, 12846, 7992, 3467, 5804, 25005, 25963, 9248, 24996, 30175, 26054, 6011, 10387, 17234, 1777, 18096, 21775, 14547, 14801, 26405, 28336, 2089, 20324, 4844, 16406, 18179, 26093, 4432, 19758, 7214, 12626, 3502, 32434, 19723, 8898, 12423, 9967, 16193, 13210, 20178, 17355, 17071, 22410, 9111, 8710, 14245, 23028, 18361, 17856, 25939, 10900, 23572, 15420, 5249, 23910, 6599, 15075, 17025, 25028, 15571, 12172, 98, 13519, 31974, 9722, 21095, 4881, 2161, 9894, 9143, 28001, 13824, 29375, 8790, 9478, 24523, 16752, 5972, 21279, 7560, 25185, 3909, 8002, 20612, 27008, 26353, 26979, 13810, 18433, 4172, 19191, 29571, 30371, 9128, 13146, 21047, 5430, 4393, 9070, 7026, 9050, 1657, 19590, 19538, 13961, 23742, 5762, 4928, 20824, 8905, 20795, 19397, 16377, 6032, 5409, 27807, 7685, 10463, 5922, 7189, 27000, 19018, 29646, 24199, 18174, 14438, 13753, 4937, 23405, 31801, 6945, 13234, 24210, 17134, 24273, 2159, 19248, 24013, 2117, 18717, 20550, 32363, 1807, 23064, 26513, 798, 7546, 7309, 13650, 26548, 24172, 1239, 5457, 11877, 17041, 27400, 31010, 21765, 6325, 18885, 31655, 10879, 21874, 24408, 19926, 6270, 1548, 25856, 24764, 13677, 27289, 20619, 28866, 12962, 31589, 21543, 22064, 31446, 23956, 4214, 16111, 5337, 2825, 11488, 13715, 7811, 12679, 18989, 6553, 29678, 3350, 851, 27884, 22242, 16809, 28812, 6830, 10897, 30717, 24748, 6966, 6021, 16836, 15538, 6485, 11222, 2307, 18845, 31966, 19360, 3769, 15489, 32357, 1460, 15553, 21721, 10310, 8334, 20217, 28959, 26858, 29576, 6052, 20890, 6725, 24653, 25357, 32120, 8867, 143, 15982, 32284, 4773, 23549, 9743, 25785, 25734, 14959, 24242, 20000, 16547, 26212, 32303, 22742, 27451, 29615, 26460, 16746, 16243, 24173, 15663, 6405, 23453, 5690, 4391, 19011, 25273, 18853, 20711, 24641, 30524, 1505, 14117, 17400, 21265, 32445, 17346, 25545, 8414, 4821, 32570, 31064, 31368, 24586, 3391, 24990, 12537, 31793, 21153, 15162, 16673, 9736, 12913, 16136, 6714, 622, 9830, 1781, 6481, 14803, 13951, 14098 };

LoadArray(massA3, sizeof(massA3) / sizeof(massA3[0]));

}

// Кнопка запуска сортировки

private: System::Void runBtn\_Click(System::Object^ sender, System::EventArgs^ e) {

if (radixSortBtn->Checked) {

SortAndDisplay(arr, gcnew Action<array<long>^>(this, &MainForm::radixSort));

}

else if (insertionSortBtn->Checked) {

SortAndDisplay(arr, gcnew Action<array<long>^>(this, &MainForm::insertionSort));

}

else if (bubbleSortBtn->Checked) {

SortAndDisplay(arr, gcnew Action<array<long>^>(this, &MainForm::bubbleSort));

}

else if (shakerSortBtn->Checked) {

SortAndDisplay(arr, gcnew Action<array<long>^>(this, &MainForm::shakerSort));

}

else if (quickSortBtn->Checked) {

SortAndDisplay(arr, gcnew Action<array<long>^>(this, &MainForm::quickSort));

}

else {

MessageBox::Show("Выберите метод сортировки!", "Ошибка", MessageBoxButtons::OK, MessageBoxIcon::Error);

return;

}

}

// Кнопка сброса данных

private: System::Void resetBtn\_Click(System::Object^ sender, System::EventArgs^ e) {

arrType1Btn->Checked = false;

arrType2Btn->Checked = false;

arrType3Btn->Checked = false;

radixSortBtn->Checked = false;

insertionSortBtn->Checked = false;

bubbleSortBtn->Checked = false;

shakerSortBtn->Checked = false;

quickSortBtn->Checked = false;

timerLabel->Text = "Время выполнения сортировки:";

outputLabel->Text = "Здесь будет отображаться выбранный\nвами массив в отсортированном виде";

inputLabel->Text = "Здесь будет отображаться выбранный\nвами неотсортированный массив";

timer->Stop();

}

// Кнопка открытия окна информации о программе

private: System::Void infoBtn\_Click(System::Object^ sender, System::EventArgs^ e) {

MessageBox::Show("Работа с программой\r\n\r\nДля работы с программой:\r\n\r\n1. Выберите один из трёх вариантов массива и дождитесь его загрузки (после загрузки, он появется в окне \"Входные данные\").\r\n\r\n2. Выберите один из пяти видов сортировки массива.\r\n\r\n3. Нажмите на кнопку \"Запуск\" и дождитесь, пока отсортируется массив (после загрузки отсортированный массив появится в окне \"Результат\")\r\n\r\nДля повторного использования программы нажмите кнопку \"Сброс\" и повторие вышеперечисленные действия.", "Информация о работе программы", MessageBoxButtons::OK, MessageBoxIcon::Information);

}

private: System::Void testBtn\_Click(System::Object^ sender, System::EventArgs^ e)

{

bool testRes = test1() + test2() + test3() + test4() + test5();

if (testRes == 0)

{

MessageBox::Show("Все тесты успешно пройдены.\r\n\r\n Программа работает корректно.", "Результаты тестирования", MessageBoxButtons::OK, MessageBoxIcon::Information);

} else{

MessageBox::Show("Тесты не пройдены.\r\n\r\n Программа работает не корректно.", "Результаты тестирования", MessageBoxButtons::OK, MessageBoxIcon::Error);

}

}

// -- [ Тесты ] --

//

int test1()

{

array<long>^ arr = gcnew array<long> {1, 4, 3, 6, 5, 2};

array<long>^ arrRes = gcnew array<long> {1, 2, 3, 4, 5, 6};

radixSort(arr);

bool arraysEqual = true;

for (int i = 0; i < arr->Length; ++i)

{

if (arr[i] != arrRes[i])

{

arraysEqual = false;

break;

}

}

if (arraysEqual)

{

return 0;

}

else

{

return 1;

}

}

int test2()

{

array<long>^ arr = gcnew array<long> {1, 4, 3, 6, 5, 2};

array<long>^ arrRes = gcnew array<long> {1, 2, 3, 4, 5, 6};

insertionSort(arr);

bool arraysEqual = true;

for (int i = 0; i < arr->Length; ++i)

{

if (arr[i] != arrRes[i])

{

arraysEqual = false;

break;

}

}

if (arraysEqual)

{

return 0;

}

else

{

return 1;

}

}

int test3()

{

array<long>^ arr = gcnew array<long> {1, 4, 3, 6, 5, 2};

array<long>^ arrRes = gcnew array<long> {1, 2, 3, 4, 5, 6};

bubbleSort(arr);

bool arraysEqual = true;

for (int i = 0; i < arr->Length; ++i)

{

if (arr[i] != arrRes[i])

{

arraysEqual = false;

break;

}

}

if (arraysEqual)

{

return 0;

}

else

{

return 1;

}

}

int test4()

{

array<long>^ arr = gcnew array<long> {1, 4, 3, 6, 5, 2};

array<long>^ arrRes = gcnew array<long> {1, 2, 3, 4, 5, 6};

shakerSort(arr);

bool arraysEqual = true;

for (int i = 0; i < arr->Length; ++i)

{

if (arr[i] != arrRes[i])

{

arraysEqual = false;

break;

}

}

if (arraysEqual)

{

return 0;

}

else

{

return 1;

}

}

int test5()

{

array<long>^ arr = gcnew array<long> {1, 4, 3, 6, 5, 2};

array<long>^ arrRes = gcnew array<long> {1, 2, 3, 4, 5, 6};

quickSort(arr);

bool arraysEqual = true;

for (int i = 0; i < arr->Length; ++i)

{

if (arr[i] != arrRes[i])

{

arraysEqual = false;

break;

}

}

if (arraysEqual)

{

return 0;

}

else

{

return 1;

}

}

};

}

# Приложение И

# Листинг программы, файл MainForm.cpp

#include "MainForm.h"

using namespace::System;

using namespace::System::Windows::Forms;

[STAThreadAttribute]

int main()

{

Application::EnableVisualStyles();

Application::SetCompatibleTextRenderingDefault(false);

UniLab2::MainForm form;

Application::Run(% form);

}